VOL. 2. NO. 9.

THE

Sidereal Messenger.

Conducted by Wm. W. PAYNE,

Director of Carleton College Observatory.

DECEMBER, 1883.

CONTENTS:

"To impress upon the mind the reality of the perfection of the works of the omnipotent, the living GOD."—Professor JAMES C. WATSON.

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The Sidereal Messenger.

Conducted by WM. W. PAYNE, Director of Carleton College Observatory.

"In the present small treatise I set forth some matters of interest to all observers of natural phenomena to look at and consider."—GALILEO, *Sidereus Nuncius*, 1610.

VOL. 2. NO. 9. DECEMBER, 1883. WHOLE NO. 19.

THE TOOLS OF THE ASTRONOMER.

PROFESSOR M. W. HARRINGTON, ANN ARBOR, MICH.

(*Continued from page 251.*)

The characteristic instrument, the astrolabe, is a combination of divided circles, so arranged that angles in all directions may be measured with some approach to precision. The circles were provided with sights, to imagine which we may think of rifle-sights. These seem to be what the ancients called diopters and when the diopter was a tube it has given rise to the surmise that it contained lenses, but the surmise is founded on insufficient data. That the lens and parabolic mirror were known in those days we need not deny, but that they were employed telescopically we have not only no clear evidence but a strong negative presumption. Had they been so used, the Almagest would have been a very different book from that which we know. With astrolabe was a complement of other instruments, partly derived from the preceding age as gnomon and water-clock, partly minor instruments of its own age as armillary spheres, planispheres, celestial globes.

Geometry and mechanics were already represented in Euclid and Archimedes and the science only awaited the

invention of necessary instruments. The instrumental means was found in Hipparch's astrolabe and on its employment followed at once an addition to the science. Hipparch ascertained roughly the distance of the *Sun* and *Moon* from the *Earth*, discovered precession, made a star-list, gave tables to the solar and planetary theory, and gave closer values to the lunar month and solar year, thus laying the foundation for the Julian reform of the calendar. For his work he invented a plane trigonometry and a method of map-projection and he was the best geographer the world had seen so far, and indeed for long afterwards. Ptolemy followed with a lunar theory very complete for the time, the rudiments of spherical trigonometry and the elements of optics. Then the capacity of the instrument with the helps then known seemed exhausted. For twelve hundred years no worthy successor followed, astronomy disappeared in its Grecian home but found a foreign nurse in the Arabs.

Again the period of growth of this branch of the tree of knowledge was heralded by a new instrument. The clock was invented and a better means of dividing time thus introduced. Ruder forms had probably been in existence for some time before but the first of which we have any description date from about the middle of the fourteenth century. The pendulum was not employed for two or three centuries afterwards. The early clocks were regulated by a balance and were approximate in their results. They were so superior to the time-instruments previously employed, that they were adopted by astronomers. Yet as their development was slow, it was not until the fifteenth century that they came fairly into use, but from this time they were employed by the best observers. The increased accuracy which they gave made possible the Copernican theory and Kepler's laws on which the astronomy of the present day is built.

In astronomy, time is one of the co-ordinates of greatest importance. Of all phenomena we must know two fundamental things, the time and the place. For the determination of the time the human mind has hit upon several devices. Naturally the earliest method would be to get the

time directly from the motions of the heavenly bodies, the rising and setting of the *Sun, Moon* and stars. This method would be employed by simple and nomadic people and we find evidence in the dramas that it was a popular method in the complex society of historic Greece. But it is incapable of accuracy or minuteness and must in time be superceded.

Another and a natural idea would be to make the chief time-giver, the *Sun*, indicate directly the time of day by direction of a shadow. This is the sun-dial, which was the chief reliance of antiquity, continued a favorite until two or three centuries ago and still survives as an ornament. The great number of neat problems given by varying the direction and the lay and shape of the receiving surface has always made this instrumont a favorite with old-fashioned mathematicians and furnishes a field not yet exhausted for any one who has nothing better to do.

Then as time is simply succession, there would be suggested its measurement by anything proceeding uniformily and continuously as it does. Hence measurement by the regulated flow of water from one vessel into another, making the instrument called the water-clock or clepsydra. This was in use in Roman courts of law and in other places to limit the length of speeches, and contemporary references show us that it was neither unusual nor difficult for one side to persuade the care-taker of the clepsydra to surreptuously lessen the capacity of the receptacle by the insertion of a layer of wax thus limiting the dangerous eloquence of the other party. 'Tis a practical means of putting an end to a prosy speech which is unfortunately not now available. On the same principle could be employed the flow of sand. Hence an instrument surviving in the hour-glass of Father Time and the minute-glass by which we boil eggs. Of the same character was the measurment of time by the wasting of a burning taper or the singing of hymns. These methods were employed in the old cloisters, and the latter challenges our admiration as probably the most manageable method of time-measurement ever discovered.

In the dial we have a time-indicator, in the clepsydra a

duration-measure, in the clock the two are combined. The invention of this important instrument is lost in obscurity. Wheel-work set in motion by springs and weights seems to have been known to the ancients, and Archimedes is believed to have had such work of his own invention. To make a time-piece a regulator was needed and this was not found for many centuries and came then in the form of first, a fly-wheel, later a balance without spring. About the middle of the seventeenth century the pendulum and a few years later, the spring-balance were employed and gave to clocks and watches the isochronism they required. To make them independent of temperature and so change them into chronometers and regulators a compensating apparatus was necessary, and this followed half a century later. In the century and a half since they have been improved only in details. But even chronometers gave only the transient indication of the time, we require farther that the time be recorded automatically in a comprehensible form, and so eliminate the judgment as to the exact fraction of a second in which a phenomenon occurs. This is done by the chronograph, or time-writer, by the development of which the minuteness of the division of time can be carried indefinitely far.

This period was terminated by the invention of the telescope at the beginning of the seventeenth century. During this period the allied sciences had made considerable advances. Columbus had discovered America, Magellan had circumnavagated the earth, algebra was developed by Cardan and others, Gregory had reformed the calendar, arithmetic and mechanics had been greatly improved, Jansen had made the microscope, Galileo the thermometer. Astronomical observations had accumulated until they culminated in Copernicus' theory, Kepler's laws, Bayer's Uranometria. That magnificent constellation of astronomers, Fabricius, Brahe, Galileo, Kepler, Burgi was fairly rising, Bacon was ripening the Organon in which he was to point out the true grounds of scientific knowledge. Physics and Mathematics were receiving great attention and rapid development. Modern science was fairly awaking and the

stimulant of personal rivalry was causing each student to exert himself to the utmost, when that most useful and most characteristic of astronomical instruments, the telescope, was hit upon and gave advent to a new and remarkable period of activity.

About the invention or discovery of the telescope there hangs much mystery. That lenses are ancient we are sure, for a crystal one has been found in the ruins of Nineveh; that the ancients knew their heating power is evident from passages like that in Aristophanes' Clouds where Strepsiades tells how by means of transparent spheres he could avoid paying his debts by burning up his notes from a distance. That they knew of their enlarging power we know by the not rare references among them to what we would call microscopic pictures and writings. Nero is said to have had concave emeralds through which to view the combats of gladiators, apparently he was short sighted. Spectacles were made by Salvino who died in 1317, and a doctor of those days in a book written in 1305 recommends an eyewash which, he says, enables old men to dispense with spectacles.

It is nothing new that "coming events cast their shadows before" but sometimes the shadow has astonishing length. That beginnings of the telescope are in the crystal lens of Nineveh recaching back two or three thousand years before its actual discovery. It deepens with the discovery of spectacles and takes definite form with the allusions to the magnifying capabilities of refracting glass, unmistakably laid down by Roger Bacon in the middle of the thirteenth century and referred to time and again in the next three or four centuries. While we have just occasion to be proud of what the human mind has accomplished, our pride should perhaps be fully neutralized by shame at what has escaped when just before our eyes. Discovery and invention require both seeing and thinking. The majority of men are content with the seeing. With the lens, with a knowledge of refraction and with the clear conception of the nature of magnification which Roger Bacon showed, with the actual employment of magnifying lenses for spectacles, then required only the placing of one

lens before another at a proper distance to make a telescope. But so purblind is man that rather than solve this little problem by thought, he waited for the accidental permutations of things to bring about this combination and that took three centuries and a half.

In the archives at La Hague are documents which show that John Lippershey of Middlebourg on Oct. 2, 1608, addressed a petition to the states-general praying for a patent for an instrument which enables one to see afar. A committee of the assembly tried the instrument on Oct. 4th, from the tower of the Prince Maurice's mansion. On the 6th this committe of grave Dutchmen reported that the instrument would be of public value if it were so perfected as to permit the use of both eyes at once. This double-barrelled requirement deserves a moment's attention. Perhaps the members of the committee thought in would require too much time for adults like themselves to acquire the art of shutting one eye. Perhaps the idea shocked them that with such an instrument a Dutchman's dignity would be imperilled; perhaps they pictured to themselves the time when the instrument would be common and their grave countrymen would traverse the country monocularly inspecting the horizon; perhaps they had an eye to the dignity of the most grave and revered stadtholder when inspecting the enemies' lines on the field of battle or in some safe spot adjacent to it. Whatever the reason may have been Lippershey must make a double-barreled instrument before it would receive the attention of his government and his attention was thus diverted toward a detail of small importance. And how did Lippershey find this capital combination of lenses from which was developed the perspecetive, the opera, field and marine glass and the telescope? History is silent on the question but tradition gives several stories. One ancient chronicler says that an unknown individual, man or demon, he does not know which, ordered of Lippershey who was a spectacle-maker several convex and concave lenses. He returned on the day for getting them, took a concave and a convex lens, placed them in a line before his eyes without intimating the

cause of this procedure,paid and disappeared. Lippershey was curious, tried the same combination, recognized the enlargement and fitted the lenses in a tube, thus constructing a field glass or telescope. Another story is that the proper combinatiou happened accidentally to his children at play who then happened to turn it on a weathercock on a tower. The surprise of the children at is apparent nearness awakened the attention of Lippershey and resulted in the instrument.

The assembly refused Lippershey a patent or a pension but gave him a small sum of money. This was, as they state, because it was notorious that the invention was already in the possesion of others. Among these must be counted James Metius who in a petition Oct 17th, 1608 to the states-general says that he has already the instrument offered by the bourgeois of Middlebourg and demands a patent for himself. He was also recommended to perfect his instrnment when his claims to privilege will be considered. Still further it is claimed that Jansen the maker of the microscope was also the inventor of the telescope and that stranger "whether man or demon" who gave the hint to Lippershey was really in search of Jansen's shop and came to Lippershey's by mistake. To whomever the idea may have first come the spectacle-maker and bourgeois of Middlebourg seems to have been the enterprising man who first brought the instrument into public notice. If this is true, the credit of the discovery rests with this spectacle-maker. It is not the man who has gold and silver who is powerful, but the man who by his gold adds to the great current of commerce and trade and affords employment to many men. It is not so much the man who has ideas who is useful to the race, but the man who communicates ideas, makes them public property. Nor is the discovery of the Dutch optician to be depreciated because it is made by chance. Most great discoveries appear fortuitous and the credit to the discoverer lies in having his eyes open to what is of value.

But it is to Galileo that we owe the idea of the astronomical use of the telescope; the Dutch seem to have con-

sidered it only a perspective. Having heard some account of the Dutch invention, he set himself at work to re-invent with such success that his instrument awakened intense popular interest in Venice and the republic rewarded him in 1609. His telescopes magnified but little, yet in his competent hands they resulted in a flood of discoveries which we cannot begin to enumerate. With small instruments, correlatives of our opera-glasses, the triumphant astronomer revealed in a few months more of the universe than all the preceding ages had found and shook to its foundations the Aristotelian philosophy to which the greatest men had yielded complete allegiance for two thousand years. So absolute was the overthrow of opinions before unquestioned, that many took refuge in utter incredulity and refused to submit to their senses the proofs of their own simplicity. "Ye men of Galileo, why stand ye looking up into the heavens" was the text of a Jesuit sermon intended to overwhelm the daring philosopher with ridicule. "Oh my dear Kepler," says Galileo in a letter as quoted by Grant, "how I wish we could have one hearty laugh together! Here at Padua is the principal professor of philosophy, whom I have repeatedly and earnestly requested to look at the moon and planets through my glass, which he pertinaciously refuses to do." The new planets were the work of imagination, they were in the telescope, they were the work of magic. The heavens were unchangeable and had the new planets been there they would have been seen before.

The instrument spread rapidly through the learned world, Within two years they could be found everywhere from Scotland to Italy. But though an immense advance on the nothing which preceded them, they were imperfect and we will now point out briefly the various steps which produced the instrument known to-day. The form employed by Galileo was that of an opera-glass and shortly afterward Kepler pointed out the advantages of two bi-convex lenses. In their common focus could be placed some means of indicating the center of the field, thus giving a means of pointing much superior to the sights employed before. To over-

RESULTS OF TESTS WITH THE "ALMACANTAR" IN TIME AND LATITUDE.*

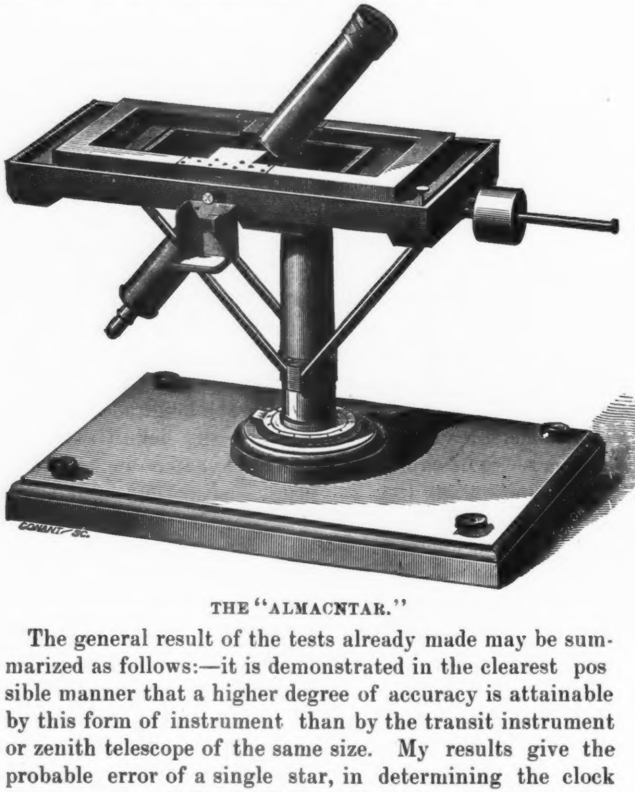
S. C. CHANDLER, JR., HARVARD COLLEGE OBSERVATORY.

At its 1880 meeting, I presented to the notice of the Association a new instrument called the Almacantar, for the determination of time and latitude. During the last two months I have subjected the instrument to a thorough test. An unusually favorable opportunity presented itself in the circumstance that a determination of the difference of longitude Montreal-Cambridge by Professors Rogers and McLeod was in progress, so that the simultaneous determination of the clock errors by the meridian instruments of the Harvard College observatory would afford a satisfactory means of comparison and judgment of the accuracy of the new principle of construction. At the same time I conducted a series of observations for the determination of the latitude of the observatory, intended to serve as a criterion of the precision of the instrument in this respect. The latitude observations are not yet complete, nor are the reductions of the observations during the longitude campaign in a sufficiently forward state to give the definitive results of the series of experiments. This I shall do in full detail in the appropriate time and place, and permit myself here only a general statement of them.

For a more complete description of the instrument and the methods of using it, I refer to the Proceedings of the Boston meeting in 1880. It must suffice here to recall that it is an equal altitude instrument in its general nature. A trough containing mercury, in the form of a hollow rectangle, revolves horizontally on an upright central pillar. The trough contains a float of similar form so arranged as to be perfectly free to seek equilibrium, while it is constrained to revolve with the trough. This float carries the telescope which turns on a horizontal axis and can be clamped at any desired altitude. Thus, as the instrument is revolved on its vertical axis any given point in

*Read at Minneapolis meeting of A. A. A. S.

the field of view describes a horizontal small circle, or almacanter, in the heavens; and the transits of stars over a series of horizontal lines will afford the means of determining the altitude of the instrument, the error of the clock, the latitude, or the declinations of the stars, by a proper distribution of the observations in azimuth.



THE "ALMACNTAR."

The general result of the tests already made may be summarized as follows:—it is demonstrated in the clearest possible manner that a higher degree of accuracy is attainable by this form of instrument than by the transit instrument or zenith telescope of the same size. My results give the probable error of a single star, in determining the clock error as only $\pm 0^s.05$ or $\pm 0^s.06$ with a transit instrument of the same size the quantity is certainly not less than $\pm 0^s.08$. With the almacantar the probable error of a single star in determining the latitude is $\pm 0''.55$, including the

error of the star's place. This is about equal to the probable error of a pair of stars by Talcott's method with the considerably larger zenith telescopes of the United States Coast survey. These results were obtained by a little instrument of 1¾ inches aperture and 25 inches focus, constructed for experimental purposes, in a provisional way, at a cost of less than one hundred and fifty dollars. When some known and obvious defects in the design and construction have been remedied these probable errors will undoubtedly be still further reduced. In illustration of its performance as a latitude-instrument I append the results obtained on a pier about eighty feet north of the dome of the Harvard College observatory. I must refer to a forthcoming publication for the details of the method used.

Date. 1882.	Star.		Latitude.			Dev. from Mean.
June 21.	μ Serpentis	W	42°	22′	48.5	+ 0.1
23.	δ Ophiuchi	E			48.5	+ 0.1
"	ϵ Ophiuchi	E			48.4	0
"	φ Virginis	W			47.4	− 1.0
"	μ Serpentis	W			48.7	+ 0.3
28.	μ Serpentis	W			49.8	+ 1.4
"	ϵ Ophiuchi	W			48.9	+ 0.5
"	λ Aquilæ	E			48.6	+ 0.2
"	λ Aquilæ	W			48.6	+ 0.2
July 10.	μ Serpentis	W			47.7	− 0.5
"	ϵ Ophiuchi	W			47.3	− 0.9
"	η Serpentis	E			48.8	+ 0.6
"	λ Ophiuchi	W			47.5	− 0.9
"	λ Aquilæ	E			49.2	+ 0.8
"	λ Aquilæ	W			48.1	− 0.3
"	η Serpentis	W			46.9	− 1.5
"	γ Ophiuchi	W			48.5	+ 0.1
"	67 Ophinchi	W			49.9	+ 1.5
	18 Stars; Mean		42	22	48.42	± 0.13
	Reduction to Dome				− 579	
	Latitude of Dome		42	22	47.63	± 0.13

given by Professor Peirce in his discussion of the prime vertical transit observations by the Messrs. Bond. and which has been heretofore adopted as the standard value of the latitude of the observatory. The difference is so large that it has led me to re-examine Professor Peirce's discussion with the result that his value is undoubtedly too large by fully three quarters of a second, that correction being due to the *substitution* of more accurate delineations of the five stars employed. I give below the values for 1845.0 of the declinations employed by Professor Peirce with those from the standard catalogue of Auwers and Boss:

STAR.	Declinations 1845.0								
	Peirce.			Auwers.			Boss.		
	°	′	″	°	′	″	°	′	″
α Lyræ	38	38	33.64	38	38	33 75	38	38	33.25
β Persei	40	21	15.27	40	21	12.82	40	21	13.69
γ Andromedae.	41	34	58.70	41	34	57.98	41	34	58.28
μ Urs. Majoris.	42	16	36 37	42	16	35.60	42	16	36.06
8 Can. Ven.	42	12	1.88	42	12	1.91			

The corresponding corrections to the latitude are as follows:

STAR.	No. obs.	Peirce.			With Auwers' declination.			With Boss'. declination.		
α Lyræ.	35½	42	22	48.57	42	22	48.67	42	22	48 18
β Persei	39½			48.47			46.02			46.89
γ Andromedae	63			48.95			48 23			48.53
8 Can. Ven	13½			47.05			47 08			
μ Urs. Majoris	16½			48.40			47.63			47.95
Mean		42	22	48.60	42	22	47.66	42	22	47.98
Reduction to dome.			—	.45		—	.45		—	.45
		42	22	48.15	42	22	47.21	42	22	47.53

From which it will be seen that even adopting the smaller correction given by Boss' declinations, the latitude of the dome, by the Bond-Peirce determination is

$$42^\circ \ 22' \ 47.5''$$

Thus the correction to the accepted value of the latitude indicated by the almacantar is confirmed

Of the results of the time determinations I must defer

It will be observed that this value is 0".7 less than that speaking more particularly at present for the reason before mentioned. But for illustration I append the clock errors for two nights, selected at random as a specimen of the ordinary working results.

The determinations were made by combining the stars in pairs east and west.

Clock Correction.

			ΔT	Dev. from Mean.
1883.	June 2,	Pair No. 1	−14.41	+.02
		2	14.47	−.04
		3	14.44	−.01
		4	14.37	+.06
		5	14.41	+.02
		6	14.48	− 05
	Mean	- -	−14.43	

			ΔT	Dev. from Mean.
1883.	June 5,	Pair No. 1	−13.30	+.04
		2	13.32	+.02
		3	13.31	+.03
		4	13.41	−.07
		5	13.35	−.01
		6	13.36	−.02
	Mean	- -	−13.34	

The result both in time and latitude would be considered satisfactory with an instrument of two or three times the size, and, when the obvious defects in the details of construction are considered, they are somewhat surprising. They certainly appear to vindicate the principle involved; and as no obstacle is apparent to the application of this principle on a larger scale, at least to instruments of five or six inches aperture, with the corresponding increase of precision from the greater optical power thus afforded, it is not unreasonable to anticipate that we have in the

almacantar promise of a new instrumental resource in the higher practical astronomy; competent, with proper development, to deal with the most delicate problems, and affording the means of evading some of the sources of minute error from which at present it is impossible to free the results obtained with meridian instruments. Especially in the determination of declinations, we have a means of eliminating the almost insuperable difficulties connected with flexure and refraction in observations with the meridian circle.

Should the above suggestions be regarded as chimerical I would ask it to be considered how much simpler the problem of mechanical construction becomes and how largely the number of sources of error is reduced. In the one case are involved: First, the accurate construction of parts, as of pivots, level, and graduated circles. Second, fixity of mounting to avoid shifting of the instrumental plane. Third, rigidity of the instrument itself to secure constancy of collimation and flexure. In the almacantar, however, the last condition is the one to be satisfied, and it is by far the easiest of the three mechanically to attain.

A remaining consideration, and a highly important one, is whether the principle of flotation adopted in the almacantar furnishes as delicate an indication of the direction of gravity as is attained with the spirit level. I think the tests with this experimental instrument are an emphatical response in the affirmative.

DOUBLE-STAR OBSERVATIONS.

P. E. SEAGRAVE, PROVIDENCE, R. I.

Star.	Mean Epoch.	Hour Angle.	Position.	Dist.	Power.	No. Obs.
		h m	° '	"		
Σ 644	1883.041	+0 36	221 58	1.60	489	3
·· 634	·· .071	+1 0	4 20	18.31		2
·· 312 A-B	.087	+1 30	21 22	2.70	··	2
·· 1630	·· .226	−2 30	165 56	2.30	··	1
·· 1553	·· .226	−3 0	169 18	5.50	··	2

Star.		Mean Epoch.	Hour Angle.		Position.		Dist.	Power	No. Obs.
			h	m	°	′	″		
Σ	314.	85Persei.087	+2	0	299	45	1.93	367	2
..	552	.. .099	+1	30	114	18	8.94	487	2
..	369	.. .099	+2	50	27	51	3.20	..	2
	872	.. .104	+0	40	218	6	11.15	..	1
..	941	.. .106	+0	50	78	2	1.88	..	2
..	928	.. .106	+1	15	134	58	3.20	..	2
..	426	.. .118	+2	0	340	7	19.64	..	2
Σ	802	.. .118	+1	20	106	44	3.26	..	2
..	973	.. .126	+0	40	27	23	11.94	..	1
..	831	.. .130	+1	45	72	33	11.28	..	2
..	349	.. .130	+3	0	319	59	6.01	..	2
..	374	.. .130	+2	30	293	20	10.69	..	2
Σ	638	.. .139	+1	44	217	2	4.79	..	2
..	390	. .139	+2	30	158	7	14.77	367	2
..	396	.. .139	+3	0	240	10	20.32	489	2
..	283	.. .144	+3	50	207	5	1.83	..	2
.	553	.. .142	+2	30	129	13	3.20	..	1
Σ	936	.. .144	+1	45	253	4	1.90	..	2
..	884	.. .146	+1	40	268	37	8.61	..	1
..	1510	.. .146	−3	20	334	20	4.13	..	2
..	1495	.. .160	−3	40	36	46	33.99	..	1
..	1362	.. .160	−1	20	130	0	4.95	..	2
Σ	1359	.. .165	−2	0	65	59	7.33	..	2
..	1872	.. .204	−4	20	37	40	7.49	..	1
..	1767	.. .204	−3	20	349	52	4.49	367	2
..	1718	.. .204	−3	40	269	39	13.13	489	2
..	1679	.. .207	−3	0	208	11	5.52	..	2
Σ	1882	.. .207	−3	35	359	57	11.31	..	2
..	1312	.. .207	−1	15	147	46	4.39	..	1
..	2571	.. .219	−5	0	21	58	11.32	..	1
..	1691	.. .219	−1	30	275	52	18.64	..	2
..	1695	.. .219	−1	45	289	21	3.18	..	2
Σ	1984	.. .219	−3	10	274	6	5.98	..	1
..	2092	.. .224	−2	45	5	41	8.03	..	2
..	2116	.. .225	−3	40	5	40	19.02	..	2
..	1654	.. .226	−2	0	25	8	3.59	..	1

FREDERICH WILHELM AUGUST ARGELANDER.

[Translated from the Swedish and arranged for publication by Professors R. B. ANDERSON and EDWARD S. HOLDEN of the University of Wisconsin.]

(*Continued from page 237.*)

Many and unusual were the honors received by Argelander during his long life; but he always remained the same unostentatious and modest man as his friends had known him to be in Finland; no less friendly to his pupils, than he was courteous and obliging to persons of the highest rank. The latter part of his life was not we are sorry to say, free from sorrow and care. With weary steps he followed two daughters to the grave; both grown up. They died from a prolonged illness. His youngest son, who was an officer in the Prussian army, died suddenly from apoplexy, far away from home. Then there happened some years ago a strange and hitherto unexplained mystery. His assistant Dr. Tiele, who for many years had had an appointment at the observatory and who had become respected and beloved by all with whom he had come in contact, disappeared one evening without any apparent cause and no trace could be found of him. After many days' search his body was found in the Rhine, several miles below Bonn. This terrible misfortune made a deep impression on all the members of the observatory, who for so long a time had had daily intercourse with the deceased. On such occasions it was Argelander's custom to seek relief and comfort at his desk or in the observatory. By severe application he sought to disperse his sad thoughts of what could not be changed.

His health was upon the whole exceedingly rugged and even to an age of over seventy years he took part in long walks without getting fatigued. Ever since his childhood he had never been really sick and it was long before his age became a burden to him. In the summer of 1874 he together with the most of the people of the observatory had a touch of typhoid fever, which however did not develop. He improved in the fall and in his letters he explained playfully that he did not think it worth while to publish bulletins in regard to his health, but at the commencement

of this year his strength began to decline. He made several efforts to continue his wonted work, but he could not stand exertion as before and on the advice of his physicians he had to abstain altogether from hard work. Thus he spent several weeks only complaining of the tediousness of being doomed to idleness until he at length on the morning of the 17th of February calmly and peacefully fell asleep for ever.

The bibliography of Dr. Argelander's works is omitted since this can be consulted in various other places.

THE VARIABLE STAR ALPHA HYDRÆ.

That *α Hydræ* is a Variable was discovered by Sir John Herschel in 1837. Argelander, in his elaborate and valuable paper on Variable Stars, inserted in the first part of the third volume of Humboldt's "Cosmos," gives the range of variation as from 2 to 2.3, and the period of fifty-five days,—but adds the remark, "Is of all variable stars the most difficult to observe." My object in addressing this communication concerning this star to the society, is to draw attention to a recent and remarkable maximum which took place about the 9th of May. On the evening of Sunday, May 6, I was, upon taking a casual glance at the south-west sky, startled by seeing a star of almost the first magnitude, vividly brilliant. It was a little before I identified it, for there was some haze, and the twilight was strong. The redness too struck me. On the 9th following, I had another opportunity of seeing and examining this star. I noticed that its color was singularly fine, a red orange, something like that of *Betelgeux*. In brightness it almost equalled *Pollux* (1.2 according to Heis) Sir John Herschel gave 2.30 as the magnitude of *α Hydræ*, and Heis gives 2. The intensity of the color and the vividness of the sparkle may have been due to atmospheric causes partly, but I hardly think so, more especially as though its scintillation was vivid, the color of *Procyon* was not deepened. The matter derives some interest from Schyellerup's note given thus in Mr. Birmingham's "Catalogue of Red Stars

"Sufi (middle of tenth century) red." The Chinese call this star the Red Bird. Perhaps it was formerly redder; and from Mr. Birmingham's own observation, annexed "pale yellowish red," I do not mean, of course, that the tint was as deep as that of *α Orionis*; but it certainly resembled it closely, and was most conspicuous. The observations were made both by the naked eye and with an opera-glass. On the 20th of February, 1882, the red color was very conspicuous and the star was very bright. I may add that recently *Pollux* has been apparently brighter than *Regulus* and its color more vivid than usual.—*Proceedings of Liverpool Astronomical Society.*

NEW TIME STANDARDS.

BY THE EDITOR.

A few weeks ago there were in the United States, the British Provinces and in Mexico more than fifty different time-standards by which all private and public business was controlled. Now, all this volume of American enterprise is governed by five standards of time which have been chosen in the joint interests of science and industry for the common end of facilitating extended communication and exchange. National interest as well as individual is concerned in this great change of time-standards, for it will tend to unify the relations of all transportation companies, thereby increasing safety to life and property, as well as making efficient and certain the growing demands of our large national life for quick and practical results.

As the thoughtful mind takes in the meaning of this recent change of time-standards over the countries before named, it is impossible to realize the magnitude of it in all its bearings. A few years ago such a thing would have been impossible in a country so large as ours, with considerable portions of its territory but sparsley settled. But now, in less than three weeks all business relations are radically changed with as much ease and unanimity as that

which attend ordinary transactions. This fact indicates much for the practical character and the rapid growth of the American people. It is indeed a rare thing in times of peace, and in the midst of a multitude of prosperous and diverse interests that always absorb the attention of prominent men, for a nation to change its modes of business so radically. It argues that our people have only to see the good results to follow the taking of any important steps, and the end is practically assured.

That our readers may have a more definite view of the geographical position of the new time-standards, a large map has been prepared and is presented herewith, which was procured and furnished to the MESSENGER by the enterprising publishers of the *Minnesota Tribune*. The names of the five standard-meridians will, in all probability, designate the time of their respective districts for the future, and as long as such a system is in force. Theoretically each meridian controls territory east and west of it to a distance of seven and a half degrees, or thirty minutes in time. This is shown by the dotted lines of the map marked, "change one hour." Practically the lines of change are neither straight lines nor are they located geographically as indicated. It was necessary to make a deviation from the theoretical plan, in order to accommodate transportation companies so that all divisions of their lines might run on the same time.

However, the reader may easily trace the actual lines of change of time between the standard meridians, by referring to the map and noting the following directions:

As already stated in the *Minnesota Tribune*: "The object of changing time half way between the standard meridians is that the new time shall not differ more than one-half hour from the true local time at any place. Although in passing these lines railway time changes one full hour, the error in true local time anywhere can be only one-half hour. This is one of the best and neatest points in the scheme. Practically, the change of time can not be made on the dotted lines exactly. In most cases it is to be made a little on one side or the other of the meridians

indicated by these lines, so that all railway divisions may be managed on the same time. Between the Pacific and the Mountain meridians the real line of change runs through the western part of Montana, angling to the east through Idaho to Salt Lake City; thence back again west to the head of the Gulf of California. Between the Mountain and Central meridians the line of change is quite straight, but much nearer to meridian 105 than the other. Its nearest point of approach is in the eastern part of New Mexico. The line between the Central and Eastern meridians is most devious. It passes down the eastern shore of Lake Huron through Detroit, Cleveland, Pittsburg, west side of North and South Carolina, and to the Atlantic a little south of Charleston. The place of change between the Eastern and the Intercolonial divisions is on a line running southeast and northwest through the middle of the state of Maine. From this delineation it will be seen that the territory belonging to the Central meridian is fully double that of any other, and consequently the amount of change from local time on its limits greater than the half hour in some cases."

While there are some disadvantages to the new system which will readily occur to the reader, the advantages derived from it are many and more important:

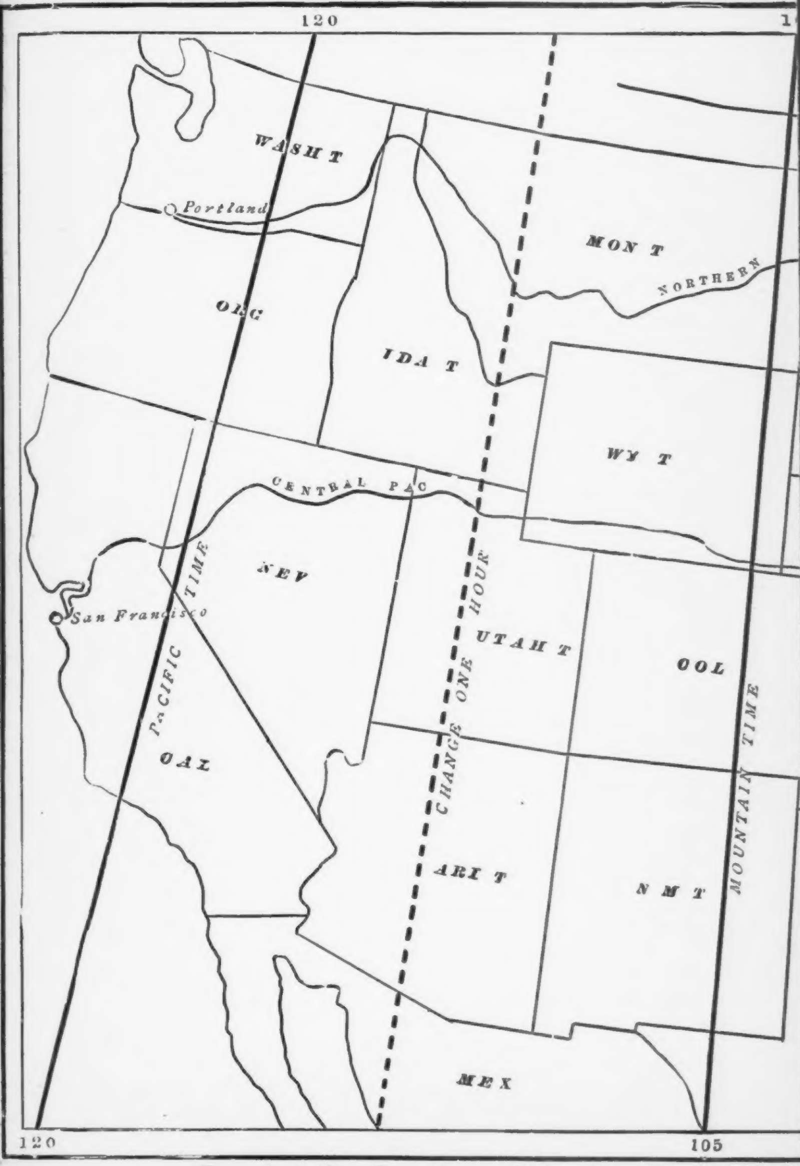
(1) "The business of all the great centers of commerce on this continent will have but five different standards of time instead of fifty, according to the old practice.

(2) Time will be kept by several different observatories for each of the five meridians, and so greater uniformity will be secured.

(3) The means of knowing accurate time generally will be greatly increased, because the call for it in given localities will be much more general.

(4) It will greatly lessen the work of transportation companies in regard to railway time-cards, and thereby tend to secure the traveling public against accident and loss of life and property.

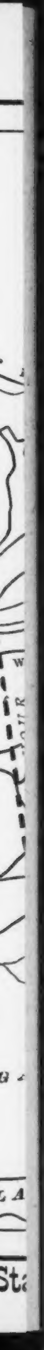
These are only a few of the advantages of the new system which have commended it to the public generally, and latest advices indicate its adoption all over the United States.

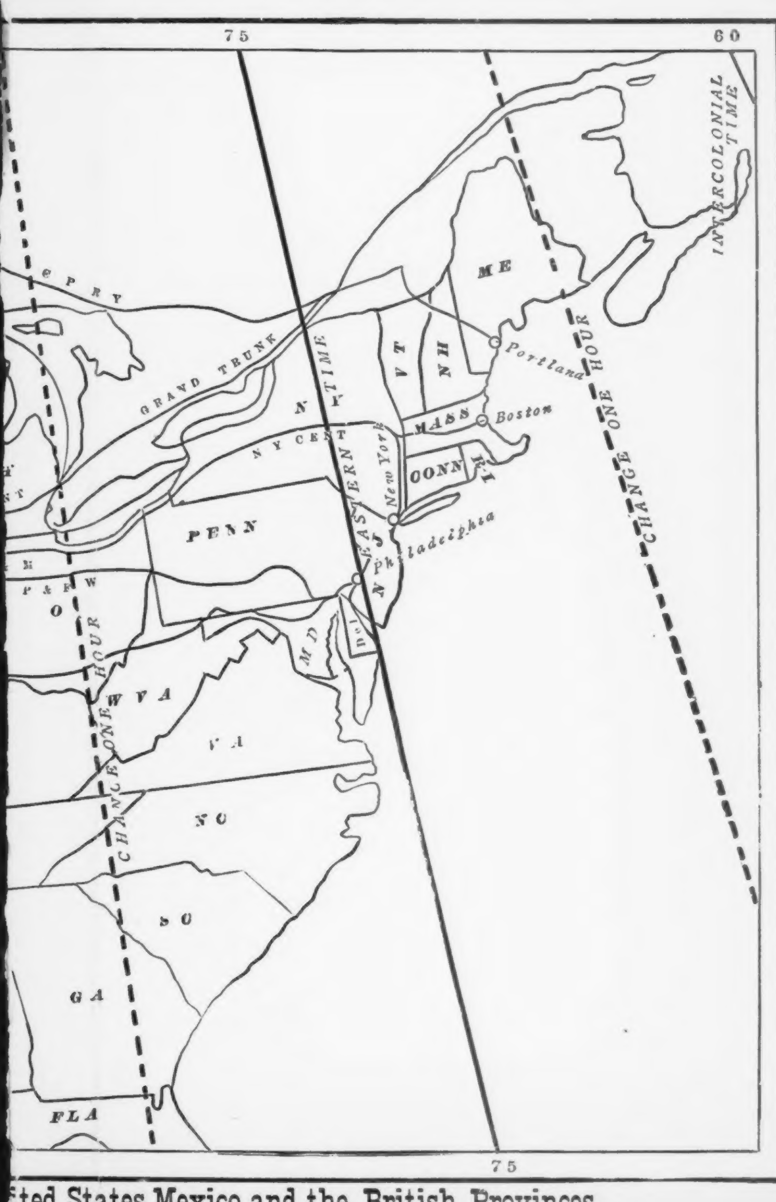


Showing the Location of the Five Time Distri

NEW STANDARD TIME MAP

cts, and the New Standard Time Meridians for the United Sta





ited States Mexico and the British Provinces.

Extract from PROFESSOR PICKERING'S *Address before a late Meeting of the Liverpool Astronomical Society.*

The encouragement of astronomy, which your society has in view, is an important work, and it gives me great pleasure to address you. I would speak to-night more particularly about the work to be done in connection with the stellar light and stellar variation. In this branch of astronomy valuable work can be done with the unassisted eye or with a small telescope or opera-glass. First of all, as regards star-magnitudes, the earliest catalogue, that of Ptolemy, dates nearly 2,000 years ago. In it the determinations of brightness are shown by numbers. The faintest star has the number *six* affixed, and the brightest *one*. But as there are many stars of the same magnitude and yet differing in brightness, the Greek letters μ or ε were affixed, signifying the words μείζων or ἐλάσσων (greater or less). Various copies of this work are in existence, and valuable work might be done if some gentleman, who possessed classical and astronomical skill, were to compile the differences in these copies. The variation between the MSS. is very considerable. Bailey found that the assigned magnitudes or positions varied in three-fourths of the total number of stars. The great authority at present is a ninth century MS at Paris in the national library. A century ago Sir W. Herschel commenced his photometric measures, his method being to speak of a star as brighter or fainter than some other star. He designated small differences of magnitude by means of a period, a comma, or a dash and their combinations. Four catalogues are given in the 'Philosophical Transactions.' They attracted little attention, however, as there were no absolute determinations of magnitude. At Harvard College all the stars down to the sixth magnitude inclusive have been photometrically observed, and by means of these measures we have been able to represent in numbers the estimates of Herschel. But these four catalogues refer only to parts of the sky. Only two-thirds are there given. While in London I was allowed, by the kindness of the

possessors of the original manuscripts of Sir W. Herschel, to inspect them, and amongst them I found two more catalogues which had remained unpublished. A note was attached, in Miss Caroline Herschel's handwriting, stating that they were ready for the press. They had been left to Sir John Herschel, and, probably through pressure of work, he did not publish them, or else did not realize their value. I was allowed to make a copy of these two catalogues, and have forwarded them to Harvard. (Great applause.) No similar work of equal accuracy has appeared till within the last ten years. Half a century later Argelander, the greatest observer, perhaps, who has ever lived, discovered the same method independently, and for a long time, so slow was intercommunication in those days, was not aware of Sir W. Herschel's earlier work. Argelander's method is one of the most precise. The principal difference between his and Herschel's is that the former used a notation while he used numbers. If the difference was small he called it 'one grade,' if distinctly visible 'two grades,' and so on. There are 25,000 observations of his in the 'Bonn Observations.' The great difficulty at present, which any one studying the magnitude of the stars as they were in former years has to encounter, is that the various observations of them are scattered far and wide in various periodicals. The results of these observations we hope to collect in one volume. While at Bonn I was allowed to see Argelander's observations. There were some 3000 or 4000 referring to the variable stars. By the kindness of Professor Schonfeld I was allowed to copy them. As many of them were written in the dark, probably with the eye at the telescope, it was a work of some difficulty to decipher them. The number of unpublished observations is very great. No piece of work is accessible to all till it is printed. At present I find, speaking from memory, that there must be nearly 170,000 unpublished observations, and not more than 40,000 published. It is greatly to be regretted that they should thus be left to accumulate, and perhaps in the end never get into print. Here let me point out a source of error liable to occur in Argelander's and Herschel's method. This is

due to the effect of one star's position with regard to another. Two stars, apparently equal, show a difference when placed one above the other. Through the varying positions of the stars as presented to the observer, have arisen many of the cases of suspected variation. The suspected variable stars amount to no less than 15,000, according to the list complied at Harvard; but many of them may have been suspected of variation through the cause just mentioned. Valuable contributions would be made to our knowledge if it could be determined why this apparent variation, due to position, exists. The question is worthy of investigation, and I would suggest the following methods:—(1) To look at the stars near the pole at different seasons of the year, or, as can be done more conveniently in your more northern latitude, early in the evening and late in the morning. (2) By inverting the position by means of a looking-glass. (3) By watching stars in the zenith, lying down on the ground, and then turning round and looking up at them in a different position. The brightest stars are less important than the fainter ones, because sufficiently observed elsewhere. The stars below the sixth magnitude are very little observed. Valuable work might be done by determining the magnitude of the stars visible in an opera-glass, in the manner of Argelander and Herschel, and especially I would reccommend those stars near the pole. Another matter of interest would be to take some of the brighter clusters, and arrange the stars in the order of brightness. Another piece of work no less valuable might be done in determining the brightness of *Uranus* and *Neptune* and of the Asteroids, some of which are probably variable. We know that one of the satellites of *Saturn* (Iapetus) varies very greatly in light; and it has been suggested, with great probability of truth, that one side is capable of reflecting more light than the other, and so we have a means of determining the time of rotation through observations of its variation. The Asteroids may vary in the same way, and the value of the observations lies in the fact that we shall thus have a probability of finding the time of rotation on their axes.—*Observatory.*

EDITORIAL NOTES.

The next number will complete the second volume of the MESSENGER. Index and title page will accompany it. Any person desiring either Vol. I. or II., bound neatly in library style, can be accommodated at $2.75 for each volume, fifteen cents extra also being charged for postage when necessary.

Professor HARRINGTON's article entitled "The Tools of the Astronomer," will hold the reader's attention very pleasantly. It contains references to the discovery, history and use of the most important astronomical instruments, and it plainly shows how wonderfully modern Astronomy has advanced by skill in observation and in the mechanism of instruments.

This number concludes that most interesting sketch of the life of FREDERICK WILHELM ARGELANDER. We know of no brief biography of this truly great man, so valuable as this, in the English language. Professors HOLDEN and ANDERSON have done the student of American Astronomy no small favor in giving in English the pen-picture of so bright an example.

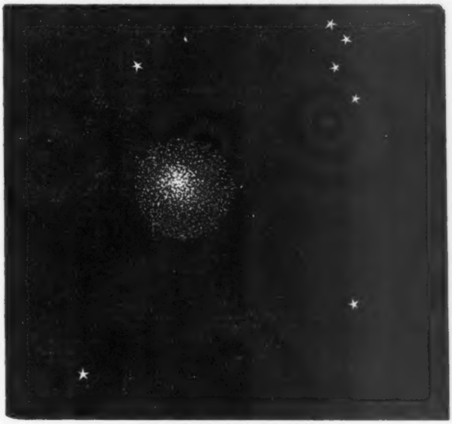
The annular eclipse of the *Sun* Oct. 30, 1883, was observed at the Davidson observatory, San Francisco, California, on the afternoon of that day. In that latitude it was seen as a partial eclipse and not annular, because the point of observation was not west far enough. Several portable telescopes were mounted outside of the observatory, but the atmosphere was so unsteady that the lower powers only were serviceable. Inside, the full aperture of the 6.4-inch instrument with with double-image micrometer was used having a power of over 200 diameters.

The first contact of the *Moon's* limb with that of the *Sun* occurred at the exact point expected, about six minutes later than the expected time.

The mean time observed was 3^h 43^m 13.5^s; and the observers were Messrs. DICKENS, MARR, MORSE and HILL of the United States Coast Survey.

A large number of visitors was permitted to view the eclipse while in progress, the solar disc being projected on a screen for that purpose. The greatest observation took place a few minutes before sunset, at which time the disc was seen to be greatly distorted by refraction. Mr. HENRY W. FAUST of San Francisco, kindly furnished us these facts with other useful astronomical news.

The Pons-Brooks comet is now (Oct. 30) near the southern limit of the constellation of *Draco*, and is moving more than three times as rapidly to the east as to the south; its motion eastward being nearly a degree daily while southward only about eighteen minutes of arc. It is about the brightness of a sixth magnitude star, though at night too low in attitude to be seen by the naked eye. An opera-glass ought to show it, and observers are directed to look directly north of the bright star *Vega* ten degrees and it will be easiiy found. If a line be drawn from *Vega* to *Gamma* in the head of *Draco*, about one third of the distance from the latter star and a little to the west is the comet's position more closely.



PONS-BROOKS' COMET.

We present a drawing of the comet as it appeared in the telescope of Carleton college observatory October 26, 8^h mean time. The small stars are seventh or eighth magnitude and are not identified. The drawing was done by Miss A. Armsby, professor of Latin. The comet will probably be visible to the unaided eye by the middle of December if not before, unless some of those curious physical changes in the nucleus take place concerning which no prediction at all can be made. Dec. 3 the comet will be less than 100 millions of miles from us, and will continue to approach both the *Sun* and the *Earth* for two months longer. Observations given below will indicate something of the physical changes which have taken place recently.

COMET *b* 1883.

Sept. 25, 8^h. Comet quite bright, slight central condensation. Near *Eta Draconis*.

Sept. 26. Moved slightly. A small misty object. Pretty regular in outline. A rather tremulous night.

Oct. 1. Not as much condensation at the center as on the 25th of Sept. Edges ill defined.

Oct. 4. Not much change except in position. Rather faint.

Oct. 19, 9^h. Swept for some time without success, finally picked it up near *Mu Draconis*. It is fainter than formerly and hardly discernible. Too faint to make out anything.

Oct. 20, 8^h. Comet still excessively faint. Definition poor.

Nov. 18, 9^h. Very bright and quite dense, larger than on the 20th of October. An easy object.

All the above observations were made with a 1½-inch glass and a power of 50. W. C. P.

Hartford, Conn.

BALTIMORE OBSERVATIONS.

Sept. 20, 8^h—Aperture 5 inches, power 45. Comet Pons seen and estimated at 9th magnitude. Is like a star though the slight haze around it is not to be mistaken.

Sept. 24—Cloudy since last date. Comet seen with power up to 78; bears magnifying well, nucleus disappeared, but very bright nebular appearance and well condensed equal at least to seventh magnitude in brightness.

Sept 25, 6^h 45^m—Still twilight, only first magnitude stars visible to naked eye. Comet seen in telescope. Power 45. It is apparently larger.

Sept. 26, 10^h—Comet seems to be more diffuse—greater area and less light.

Oct. 2, 8^h—Comet seen very well, large nebulosity, 4′ fully; dark sky on preceding side and shading off on following side until gradually lost. Can see the central condensation and occasionally stellar point, evidently the tail is cause of shading the following side.

Oct. 8—Six days cloudy. Comet seen, some moonlight. Though faint a nucleus is seen by averted vision. Nebulosity large as Oct. 2.

Oct. 9, 8^h—Seen through nearly half moonlight. Nucleus about 9.5 magnitude.

Oct. 10, 7^h—Central condensotion of the comet is apparent.

Oct. 11, 7^h 30^m—Comet is seen only faintly. *Moon* past first quarter.

Oct. 16—Comet well seen though in full moonlight. J. H.

TRANSPARENCY OF BROOKS' COMET.

On the night of Oct. 30, 8^h 47^m, Nashville* mean time, this comet was observed centrally to transit a star of the 10th or 11th magnitude. Throughout the transit the star remained invisible. The middle of the comet was about the same brightness as the star, and it was not easy to distinguish the star at once, but by averted vision, or when 'seeing' was best, the star would flash forth in the midst of the cometary haze like a bead of light. Carefully watching the progress, I

estimated the mid-transit at the above time which I think is right within a very few minutes. The central part of the comet passed south of the star not more than 1″ or 1.″5. Aperture 5 inches, power 173.

This comet is now smaller and brighter than in the latter half of September. I have not been able in the last few observations to detect any tail. The cometary material is very diffuse at the edges, but gradually brightens toward the middle.

NASHVILLE, Tenn. F. E. B.

One of the nebulæ given by me as new in the October MESSENGER, (in field with, and *n. f.* General Catalogue 4900) proves to be number 6131 of Dreyer's Supplement, and is described as "very faint, pretty large, elliptical, gradually brighter in the middle." It is not in the General Catalogue. The other nebulæ are new so far as I know. In the November MESSENGER the minus sign was omitted before the declination of the small hole in the *Milky Way*. It should be $-27^\circ\ 51'$. E. E. B.

It has been the aim of this magazine to present to its readers, in plainly-worded language, from month to month, that which is freshest and best pertaining to the various branches of Astronomy. As no other publication of the kind exclusively devoted to this science exists in this country, it becomes necessary to try to serve the professional astronomer and also the amateur. The former needs and constantly uses correct observations, and finds theoretical and advanced studies useful; the latter has need only of that which is more elemental, and if he be not an observer that which is chiefly popular in thought and style. These two lines of work are so different that they do not easily harmonize; and yet with patience and thoughtfulness on the part of each the situation may not only be tolerable but even a great advantage to both and to the science. The public needs the outlines of the astronomer's knowledge, and it would doubtless be a blessing to the astronomer if he were required to be a benefactor to that extent.

Proffessor GODWIN D. SWAZEY, in charge of the department of National Science, Doane college, Crete, Nebraska, spent a considerable part of his late summer vacation at Carleton College observatory mainly in the study and use of astronomical instruments. As a result of his perseverance the foundation of a new observatory at Doane college is already laid, and and arrangements are now being made with manufacturers for a supply of good instruments for the purposes of college instruction and original work. He has already erected and is operating a time-ball. A full account of Professor SWAZEY'S late work will soon be given.

OBSERVATIONS OF PONS' COMET MADE AT THE NAVAL OBSERVATORY WITH 9.6-INCH EQUATORIAL. OBSERVERS: W. T. SAMPSON AND E. FRISBY.

[COMMUNICATED BY REAR-ADMIRAL SHUFELDT, SUPERINTENDENT.]

1883.		Wash. M. T.	Comet—* Δα	Comet—* Δδ	No. of Comp.	Comet. α app.	log (p× ^)	Comet. δ app.	log (p× Δ)	Obs.	Comp. Star.
		h m s	m s	′ ″		h m s		° ′ ″			
Sept.	23	8 8 24.5	+ 0 1.19	− 2 10.3	15.3	16 25 20.93	9.89564	+60 31 56.8	9.72026n	S	1
	24	11 19 47.3	+ 4 57.92	− 2 12.9	15.3	16 25 28.49	9.94552	60 16 47.8	0.76095	S	2
	26	7 42 33.3	− 0 31.98	−10 10.6	25.5	16 25 47.71	9.87342	59 52 22.8	9.82582n	S	3
	26	9 56 0.3	+ 0 16.86	+ 7 7.4	18.4	16 25 47.07	9.96138	59 51 16.0	0.41280	F*	4
	28	8 9 12.4	− 2 4.47	− 9 35.9	20.3	16 26 17.22	9.91121	59 26 16.6	9.38115	F	5
	30	9 39 24.7	+ 3 32.05	− 5 24.4	5.1	16 27 5.26		58 58 54.6		S	6
	30	9 50 37.1	+ 3 32.02	− 5 12.4	5.1	16 27 5.23	9.94434	58 58 42.6	0.57845	S	6
Oct.	2	9 30 9.2	+ 1 39.78	+ 3 46.8	25.5	16 28 2.02		58 33 52.3		S	7
	2	9 30 9.2	+ 3 12.29	+ 3 19.9	25.5	16 28 2.41	9.30293	58 33 51.8	9.51845n	S	8
	8	7 43 21.6	− 0 48.60	+ 6 4.3	25.5	16 32 2.33	9.88741	57 16 55.5	9.73798	S	9
	9	7 17 34.7	0 0.00	− 6 27.7	10.2	16 32 50.90		57 4 23.3		S	9
	9	7 24 12.3	0 0.00	− 6 31.6	10.2	16 32 50.90	9.87016	57 4 19.4	9.39904	S	9
	10	7 22 41.5	− 9 20.48	− 7 57.0	15.3	16 33 43.74	9.86011	56 51 49.0	7 65475	S	10
	11	7 54 46.7	+ 8 5.37	−12 44.3	15.3	16 34 39.90		56 38 56.5		S	11
	11	8 6 16.5	+ 8 6.21	−12 50.3	10.2	16 34 40.74	9.89936	56 38 50.5	0.09116	S	11
	19	9 3 14.1	− 6 37.23	+ 4 45.5	10.2	16 43 45.76	9.90472	55 1 19.7	0.48745	F	12
	24	6 52 24.8	+ 2 7.06	+ 5 20.8	15.3	16 50 49.66	9.84559	54 4 23.8	9.87235	S	13
	24	7 9 40.5	+ 1 58.15	− 9 57.3	15.3	16 50 52.28	9.85554	54 3 58.0	9.99734	S	14
	24	7 43 13.8	+ 2 8.19	− 6 51.0	15.3	16 50 55.44	9.88111	54 3 43.4	0.28026	S	15
	26	7 9 43.0	− 4 36.67	−10 50.6	25.5	16 54 4.86	9.85996	53 41 9.2	9.51435	S	16
	27	7 24 50.3	− 5 30.99	+ 6 1.3	20.4	16 55 47.79	9.73856	53 29 48.1	0.25273	S	17
	29	9 10 27.2	+ 2 2.91	− 6 46.3	25.5	16 59 27.40	9.87621	53 6 25.0	0.63868	S	18
	30	6 45 21.5	− 3 36.47	+ 6 10.5	20.4	17 1 5.93		52 56 31.7		F	19
	30	6 45 21.5	− 5 5.84	+ 9 20.4	11.3	17 1 5.68		52 56 29.7		F	20
	30	6 45 21.5	− 5 28.43	+ 3 15.3	10.4	17 1 6.65	9.83976	52 56 31.1	0.00232	F	21
	30	7 27 59.8	+ 2 38.29	+ 9 33.3	15.3	17 1 10.82		52 56 12.9		S	22
	31	7 20 16.9	− 1 38.18	− 5 15.5	15.2	17 3 4.19		52 45 5.6		F	19
	31	7 20 16.9	− 3 7.77	− 2 58.9	14.2	17 3 3.73		52 45 10.3		F	20
	31	7 20 16.9	− 3 31.13	− 8 10.2	9.2	17 3 4.11	9.86293	52 45 5.5	0.27512	F	21
	31	7 49 19.2	+ 4 32.39	− 1 50.6	10.2	17 3 4.89		52 44 48.8		S	22

* Made with 26-inch Equatorial.

Unfavorable weather prevented the comet being seen before Sept. 23d. On that evening I was surprised at its brightness, as it had been described as a faint object. The light was bright yellow, without showing any decided nucleus. On the 24th, the appearance was much the same as on the previous evening. On the 25th, it was not seen. On the 26th, its appearance had changed in a most marked manner. It was much fainter and the light had lost its yellow color.

W. T. SAMPSON.

STAR	α 1883.0			δ 1883.0			Authority.
	h	m	s	°	′	″	
1	16	23	13.67	+60	34	2.4	Bonn
2	16	20	31.19	60	18	43.4	Lal. Fed.
3	16	26	20.28	60	2	15.8	$\frac{\text{O. Arg. N.} + \text{Bonn}}{2}$
4	16	25	30.79	59	43	51.1	Bonn
5	16	28	22.29	59	35	35.0	O. Arg. N.
6	16	23	33.87	59	3	38.4	O. Arg. N.
7	16	26	22.88	58	29	48.8	O. Arg. N.
8	16	24	50.77	58	30	15.4	O. Arg. N.
9	16	32	51.57	57	10	34.8	O. Arg. N.
10	16	43	4.80	56	59	28.5	Berliner Jahrbuch
11	16	26	35.40	56	51	39.4	O. Arg. N.
12	16	50	23.58	54	56	17.7	O. Arg. N.
13	16	48	43.22	53	58	48.0	O. Arg. N
14	16	48	54.77	54	13	40.2	O. Arg. N.
15	16	48	47.89	54	10	17.4	O. Arg. N.
16	16	58	42.12	53	51	43.9	O. Arg. N.
17	17	1	19.40	53	23	31.4	O. Arg. N.
18	16	57	25.10	53	12	56.3	Bonn
19	17	4	42.93	52	50	5.4	$\frac{\text{Bonn} + \text{Rumker}}{2}$
20	17	6	12.05	52	46	53.3	Bonn
21	17	6	35.62	52	52	59.7	Bonn
22	16	58	33.10	52	46	24.6	O. Arg. N.

The following notes by WILLIAM DAWSON, Spiceland, Ind., are interesting:—

November 18 and 19.—The PONS-BROOKS' comet appeared nearly round and hazy and nebulous in outline, but very bright like a star in the center. Could not perceive the appearance of a tail with certainty. The telescope used was 4.6 inches aperture, power 50. I found the comet easy with a spy-glass; and could see it easily with an opera glass.

The current sun-spot maximum undoubtedly occurred near the middle of April, 1882. But the prevalence of spots continues unexpectedly great. On April 17, '82, I counted 175 spots in nine groups. May 17, 150; and only three on 30th. They seemed to wane consider-

ably for several months. March 9, '83, only one spot, May 27, none. But a fresh outbreak occurred in July; showing 230 spots on the 24th 150 were counted Oct 15th, and ninety-five on the 1st and 17th of November. Several have been visible to naked eye.

From the San Francisco papers of recent date, it appears that the Society of California Pioneers not long ago appointed a special committee to inquire into the condition of the James Lick Trust, as managed by the existing Board of Trustees and report. We have no knowledge of that report, but presume it to be unfavorable in view of the great interest and feeling caused by it. To this report Trustee SHERMAN made answer, at a special meeting of the Society, and the document, as it appeared in print, was full, clear, explicit and every way candid and business-like. He plainly showed that the great estate is not wasted, but steadily enhancing. The Trustees were practically endorsed by the rejection of the special committee's report.

The aggregate net profit of the estate from Dec. 1, 1876 to Oct. 1, 1883, has been shown to be $453,458.67. The average income per annum, $66,559.80. It is evident that this munificent fund is one of the richest legacies to the science of Astronomy in the known world, and it appears to be in the hands of a Board of Trustees fully competent to manage it wisely and profitably.

MR. E. E. BARNARD, observatory of the Vanderbilt University, Nashville, Tenn., Nov. 17, writes: "On the 6th inst. while preparing to observe the occultation of *Beta Capricorni*, I fortunately witnessed a similar phenomenon. Preceding *Beta* by 14^s is a 7th magnitude star. The *Moon* in passing over this small star revealed the fact that it was a very close and a very unequal double. First, about nine-tenths of its light instantly disappeared, and for the space of one second there remained in its place a minute point of light estimated, of the 10th magnitude. This also instantly disappeared. I can find no record of its being a known double. I have tried to split it with the 6-inch, but have not succeeded. Its mean place for 1883.0 is

$$\text{A. R. } 20^h\ 14^m\ 12.^s03;\ \text{Decl.} -15^\circ\ 8'\ 40'' \pm.$$

It is almost on the same parallel with *Beta Capricorni* and preceding it by $14.^s2$.

The letter *a* is omitted in Almacantar under cut on page 269.

THE PLANETS FOR DECEMBER.

[The time given is Central time.]

During this month *Mercury* can not be seen without a telescope, as he rises after the *Sun*. *Venus* is now an evening star, but still sets early. On Dec. 5, at $5^h\ 18^m$; Dec. 15, $5^h\ 36^m$; Dec. 25, $5^h\ 59^m$. On the 12th, this planet is fartherest from the *Sun* at which time the angular

diameter is 11″. *Mars* rises Dec 5, at 9^h 8^m, evening; Dec. 15, 8^h 35^m; Dec. 25, 7^h 56^m. The greatest angular diameter 13″, is at the end of the month. On the 22nd the planet appears stationary. *Jupiter* rises Dec. 5, 7^h 49^m, evening; Dec. 15, 7^h 7^m; Dec. 25, 7^h 22^m. His greatest angular diameter, 44″, is on the 31st. He is in conjunction with the *Moon* on the evening of the 16th. *Saturn* rises Dec. 5, 3^h 43^m, after noon; Dec. 15, 3^h 1^m; Dec. 25, 2^h 20^m. On the 12th he is in conjunction with the *Moon*. His greatest angular diameter, 16″, is on the 1st. *Uranus* and *Neptune* can not be seen without a good telescope, and knowledge of exact positions. *Uranus* passes the meridian late in the morning. *Neptune* passes the meridian Dec 5, 9^h 58^m, evening; Dec. 17, 9^h 10^m; Dec. 29, 8^h 22^m; Dec. 5, R. A. 3^h 8^m, Decl. +15° 45′; Dec. 17, R. A. 3^h 7^m, Decl. +15° 41′; Dec. 29, R. A 3^h 6^m, Decl. +15° 37′.

BOOK NOTICES.

A treatise on the principles and Application of Analytic Geometry, by HENRY T. EDDY, C. E, Ph. D., Professor of Mathematics and Astronomy in the University of Cincinnati. Philadelphia, Messrs. Cowperthwait & Co., Publishers, 1874, pp. 200.

Though not a new book, this is one that will not depreciate with years of use. It was prepared mainly to meet the wants of Scientific and Technological schools, and colleges and universities where full courses in Mathematics are pursued. The preparation for Mechanics, Astronomy and Civil Engineering which it furnishes is certainly very complete in matter, and the method of presentation probably quite as good as it could be without the aid of the Calculus. Leading mathematicians differ greatly as to which is the wiser course to pursue in unfolding the principles of this science which depends so largely on variable quantities. Right here is the student's difficulty. In his previous study fixed values of quantities and graphic or direct methods of study have occupied his attention wholly. To use the variable he *must* have the indirect method commonly known as the Cartesian, modern, or general method. But variable quantity thought of in continuous number is exactly the province of the Calculus, and primarily that of no other branch of the mathematics. It would therefore seem as if there was no real questions whether or not the Calculus should be freely used even in an elementary cause of analytical work. We believe writers are coming of late years, more and more to recognize this, the true idea of unfolding the principles of the higher mathematics.

We have been especially interested in the latter chapters of the work which treat of Transcendential Curves, Spiral and Polar Curves. There are clearness and point in these themes that are admirable.

This book is an elegant specimen of the printer's art, and the author ought to think himself very fortunate in being able to make so pleasant an impression generally on this account.

Physical Geography, by M. F. MAURY, LL. D., late Superintendent of the National Observatory. University Publishing Co., New York and Baltimore, 1882. 4 to pp. 218.

Every student ought to know something of the researches of Lieut. MAURY in Physical Geography and kindred topics. His Physical Geography of the Sea published in 1855 passed through its sixth edition in 1856. This work was justly praised in this country and in Europe, and it placed his name at the head of the great scientific department of which it treated, in the government, which position he held until voluntary resignation in 1861. In 1868 he held the Professorship of Physics in the Military Institute of Virginia, and in 1871 declined the Presidency of the University of Alabama. He spent the last years of his life in Lexington, Va., at which place this book was written.

His school Geographies previously published and a work on Astronomy with this book make the author's contribution to the University series of school-books. His last work seems to us the best. It contains a full set of physical maps in colors that are excellent in design and execution. The text is accompanied by a great number of fine wood-cut illustrations, is full and varied as to matter, with generalization and topical arrangement well adapted to the class-room. The publishers have done their part tastefully and well.

Elements of Algebra; designed for Grammar and High Schools, Academies, Etc., by JOSEPH FICKLIN, Ph. D., Professor of Mathematics and Astronomy in the University of the State of Missouri. Messrs. A. S. Barnes & Co., New York and Chicago, pp 296.

Algebra is a necessity in modern scholarship. A few years ago knowledge of, and skill in, the use of arithmetical operations were deemed points of excellence and evidence of mental power entitling the fortunate possessor to special consideration. As good as these qualities of mental finishing are, they are by no means equal to the advantages of algebraic analysis which is growing more and more in favor in recent years as the modern Algebra, the Calculus and Determinants are developed.

In view of these facts teachers and scholars need to have the elements of Algebra adapted to the advancing condition of these higher branches. The equation should be unfolded and treated in such a way as to show its power and peculiar uses as a means of investigation. This important thought was evidently in the mind of Professor FICKLIN in the preparation of the work before us.

It is clear in statement and definition, exercises abundant, range sufficiently wide, choice of matter judicions, and gradation of work easy and natural. The mechanical part of the work is well done.